OCT 9 1922

SCIENCE

NEW SERIES
VOL. LVI, No. 1449

FRIDAY, OCTOBER 6, 1922

ANNUAL SUBSCRIPTION, $6.00
SINGLE COPIES, 15 CTS.

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

11 Liberty St., Utica, N. Y. Garrison, N. Y.

New York City: Grand Central Terminal

Annual Subscription, $6.00 Single Copies, 15 Cts.

Entered as second-class matter January 21, 1922, at the Post Office at Utica, N. Y., Under the Act of March 3, 1879.

VOL. LVI OCTOBER 6, 1922 No. 1449

CONTENTS

THE ORGANIZATION OF RESEARCH[1]

THE principles of science are to-day widely spread; systematic scientific training has found an honorable place in the schools and in the colleges; above all, there is the realization that much of human progress is based on scientific inquiry, and at last this is fostered and, in part, financed as a definite unit of national educational policy. Public funds are devoted to provide facilities for those who are competent to pursue scientific investigations, and in this way the state, acting through the Department of Scientific and Industrial Research, has assumed the double responsibility of providing for the advancement of knowledge and for the application of scientific methods to industry. Scientific workers have been given the opportunities they desired, and it remains for us to justify all that has been done. We have to-day glanced briefly at the painful toil and long years of preparation; now it falls to us to sow the first crop and reap the first harvest.

Thanks to the wisdom and foresight of others, it has been possible to frame the government policy in the light of the experience gained with pre-existing research organizations. The pioneer scheme of the kind is that administered by the commissioners of the 1851 Exhibition, who since 1890 have awarded research scholarships to selected graduates. When in 1901 Mr. Carnegie's benefaction was applied to the Scottish universities the trustees wisely determined to devote part of the revenues to the provision of research awards which take the form of scholarships, fellowships and research lectureships. These have proved an immense boon to Scottish graduates, and the success of the venture is sufficiently testified by

[1] From the address of the president of Section B—Chemistry, British Association for the Advancement of Science, Hull, September 7, 1922.

the fact that the government research scheme was largely modeled on that of the Carnegie Trust.

In each of these organizations chemistry bulks largely, and the future of our subject is intimately connected with their success or failure. The issue lies largely in our hands. We must not forget that we are only at the beginning of a great movement, and that fresh duties now devolve upon us. It was my privilege for some years to direct the work of a chemistry institute, where research was organized on lines which the operation of the government scheme will make general. If, from the very nature of things, my experience can not be lengthy it is at least intimate, and I may perhaps be allowed to lay before you my impressions of the problems we have to face.

Two main objectives lie before us: the expansion of useful learning and the diffusion of research experience among a selected class. This class in itself will form a new unit in the scientific community, and from it will emerge the "exceptional man" to whom, quoting Sir James Dewar, "we owe our reputation and no small part of our prosperity." When these words were uttered in 1902 it was a true saying that "for such men we have to wait upon the will of Heaven." It is still true, but there is no longer the same risk that the exceptional man will fall by the way through lack of means. Many types of the exceptional man will be forthcoming, and you must not imagine that I am regarding him merely as one who will occupy a university chair. He will be found more frequently in industry, where his function will be to hand on the ideas inspired by his genius to the ordinary investigator.

I have no intention of wearying you by elaborating my views on the training required to produce these different types. My task is greatly simplified if you will agree that the first step must be systematic experience in pure and disinterested research, without any reference to the more complicated problems of applied science. This is necessary, for if our technical research is to progress on sound lines the foundations must be truly laid. I have no doubt as to the prosperity of scientific industries in this country so long as we avoid hasty and premature specialization in those who control them. We may take it that in the future the great majority of expert chemists will pass through a stage in which they make their first acquaintance with the methods of research under supervision and guidance. The movement is already in progress. The government grants are awarded generously and widely. The conditions attached are moderate and reasonable, and there is a rush to chemical research in our colleges. Here, then, I issue my first note of warning, and it is to the professors. It is an easy matter to nominate a research student; a research laboratory comfortably filled with workers is an inspiring sight, but there are few more harassing duties than those which involve the direction of young research chemists. No matter how great their enthusiasm and abilities, these pupils have to be trained, guided, inspired, and this help can come only from the man of mature years and experience. I am well aware that scorn has been poured on the idea that research requires training. No doubt the word is an expression of intellectual freedom, but I have seen too many good investigators spoiled and discouraged through lack of this help to hold any other opinion than that training is necessary. I remember, too, years when I wandered more or less aimlessly down the by-paths of pointless inquiries, and I then learned to realize the necessity of economizing the time and effort of others.

The duties of such a supervisor can not be light. He must possess versatility; for although a "research school" will doubtless preserve one particular type of problem as its main feature, there must be a sufficient variety of topics if narrow specialization is to be avoided. Remember, also, that there can be no formal course of instruction suitable for groups of students, no common course applicable to all pupils and all inquiries. Individual attention is the first necessity, and the educative value of early researches is largely derived from the daily consultations at the laboratory bench or in the library. The responsibility of becoming a research supervisor is great, and, even with the best of good will, many find it difficult to enter sympathetically into the

mental position of the beginner. An unexpected result is obtained, an analysis fails to agree, and the supervisor, out of his long experience, can explain the anomaly at once, and generally does so. If the pupil is to derive any real benefit from his difficulties, his adviser must for the moment place himself in the position of one equally puzzled, and must lead his collaborator to sum up the evidence and arrive at the correct conclusion for himself. The policy thus outlined is, I believe, sound, but it makes severe demands on patience, sympathy, and, above all, time.

Research supervision, if conscientiously given, involves the complete absorption of the director's energy and leisure. There is a rich reward in seeing pupils develop as independent thinkers and workers, but the supervisor has to pay the price of seeing his own research output fade away. He will have more conjoint papers, but fewer individual publications, and limitations will be placed on the nature of his work by the restricted technique of his pupils.

I have defined a high standard, almost an ideal, but there is, of course; the easy alternative to use the technical skill of the graduate to carry out the more laborious and mechanical parts of one's own researches, to regard these young workers as so many extra pairs of hands. I need not elaborate the outcome of such a policy.

There is another temptation, and that, in an institution of university rank, is for the professor to leave research training in the hands of his lecturers, selecting as his collaborators only those workers who have passed the apprenticeship stage. This, I am convinced, is a mistake. Nothing consolidates a research school more firmly than the feeling that all who labor in its interests are recognized by having assigned to them collaborators of real ability.

I am not yet done with the professor and his staff, for they will have other matters to attend to if research schools are to justify their existence and to do more than add to the bulk of our journals. In many cases it will be found that the most gifted of the young workers under their care lack what, for want of a better expression, is known as "general culture." Remember, these graduates have just emerged from a period of intensive study in which chemistry and the allied sciences have absorbed most of their attention. For their own sake and in the interests of our subject, they must be protected from the criticism that a scientific education is limited in outlook and leads to a narrow specialism. The research years are plastic years, and many opportunities may be found in the course of the daily consultations "to impress upon the student that there is literature other than the records of scientific papers, and music beyond the range of student songs." I mention only two of the many things which may be added to elevate and refine the research student's life. Others will at once occur to you, but I turn to an entirely different feature of research training, for which I make a special plea: I refer to the inculcation of business-like methods. You will not accuse me, I hope, of departing from the spirit of scholarship or of descending into petty detail, but my experience has been that research students require firm handling. Emancipated as they are from the restrictions of undergraduate study, the idea seems to prevail that these workers ought to be excused the rules which usually govern a teaching laboratory, and may therefore work in any manner they choose. It requires, in fact, the force of a personal example to demonstrate to them that research work can be carried out with all the neatness and care demanded by quantitative analysis. Again, in the exercise of their new freedom young collaborators are inclined to neglect recording their results in a manner which secures a permanent record and is of use to the senior collaborator. As a rule, the compilation of results for publication is not done by the experimenter, and a somewhat elaborate system of records has to be devised. It should be possible, twenty years after the work has been done, to quote the reasons which led to the initiation of each experiment, and to trace the source and history of each specimen analyzed, or upon which standard physical constants have been determined. I need not enter into detail in this connection beyond stating that, although a system which secures these objects has for many years been adopted in St. Andrews, con-

stant effort is required to maintain the standard.

One of the greatest anxieties of the research supervisor is, however, the avoidance of extravagance and waste. The student is sometimes inclined to assume a lordly attitude and to regard such matters as the systematic recovery of solvents as beneath his notice. My view is that, as a matter of discipline as much as in the interests of economy, extravagant working should not be tolerated. There is naturally an economic limit where the time spent in such economics exceeds in value the materials saved, and a correct balance must be adjusted. It is often instructive to lay before a research worker an estimate of the cost of an investigation in which these factors of time and material are taken into account. As a general rule it will be found that the saving of material is of greater moment than the loss of time. The point may not be vitally important in the academic laboratory, but in the factory, to which most of these workers eventually migrate, they will soon have the lesson thrust upon them that their time and salary bear a small proportion to costs of production.

You will see I have changed my warning from the professor to the student. A student generation is short. In a few years, when almost as a matter of course the best of young chemists will qualify for the doctor of philosophy degree, it will be forgotten that these facilities have come to us, not as a right, but as a privilege. Those who reap the advantages of these privileges must prove that the efforts made on their behalf have been worth while.

Looking at the position broadly, if one may criticize the research schemes of to-day, it is in the sense that the main bulk of support is afforded to the research apprentice, and the situation has become infinitely harder for the supervisor in that new and onerous tasks are imposed upon him. To expect him to undertake his normal duties and, as a voluntary act, the additional burden of research training is to force him into the devastation of late hours and overwork. The question is at once raised —Are we using our mature research material to the best advantage, and is our policy sufficiently focussed on the requirements of the experienced investigator? I think it will generally be agreed that members of the professor or lecturer class who join in the movement must be relieved in great measure of teaching and administrative work. I am decidedly of the opinion that the research supervisor must be a teacher, and must mingle freely with undergraduates, so as to recognize at the earliest possible stage the potential investigators of the future and guide their studies. To meet this necessity universities and colleges must realize that their curriculum has been extended and that staffs must be enlarged accordingly. There could then be definite periods of freedom from official duties for those who undertake research training as an added task. Opportunities must also be given to these "exceptional men" to travel occasionally to other centers and refresh themselves in the company of kindred workers. It is evident that our universities are called upon to share the financial burden involved in a national research scheme to a much greater extent than possibly they know.

I may perhaps summarize some of the conclusions reached in thinking over these questions. The first and most important is that in each institution there should be a board or standing committee entrusted with the supervision of research. The functions of such a body would be widely varied and would include:

1. The allocation of money voted specifically from university or college funds for research expenses.

2. The power to recommend additions to the teaching staff in departments actively engaged in research.

3. The recommendation of promotions on the basis of research achievement.

4. The supervision of regulations governing higher degrees.

Among the more specific problems which confront this board are the following:

1. The creation of research libraries where reference works can be consulted immediately.

2. The provision of publication grants, so that where no periodical literature is available the work will not remain buried or obscure.

3. The allocation of traveling grants to en-

able workers to visit libraries, to inspect manufacturing processes, and to attend the meetings of scientific societies.

There is one thing which a research board should avoid. It is, I am convinced, a mistake for a governing body to call for an annual list of publications from research laboratories. Nothing could be more injurious to the true atmosphere of research than the feeling of pressure that papers must be published or the department will be discredited.

What I have said so far may seem largely a recital of new difficulties, but they are not insurmountable, and to overcome them adds a zest to life. It would have taken too long to go more fully into details, and I have tried to avoid making my address a research syllabus, merely giving in general terms the impressions gained during the twenty years in which the St. Andrews Research Laboratories have been in existence.

I have confined myself to the first stage in the research development of the chemist. His future path may lead him either to the factory or to the lecture-room, and in the end the exceptional man will be found in the director's laboratory or in the professor's chair. However difficult these roads may prove, I feel that with the financial aid now available, supported by the self-sacrificing labors of those who devote themselves to furthering this work, he has the opportunity to reach the goal. It is the beginning of a new scientific age, and we may look forward confidently to the time when there will be no lack of trained scientific intellects to lead our policy and direct our efforts in all that concerns the welfare of the country.

J. C. IRVINE

THE UNITED STATES FUNDAMENTAL STANDARDS OF LENGTH AND MASS

THE recently published volume containing the testimony submitted to the Senate Committee on Manufactures, in favor of and against the passage of Senate Bill 2267 "To fix the Metric System of Weights and Measures as the Single Standard of Weights and Measures for Certain Uses," contains a mass of information and misinformation of great interest to students of metrology.

The opponents of the metric system were very active in marshalling their full strength at the numerous "hearings" before the subcommittee, about half of the volume being devoted to the evidence which they furnished, either in writing or in the form of personal testimony.

These are the pages which the well informed reader will certainly find most interesting, because of the remarkably illogical arguments introduced, the total disregard of historic facts and the apparently complete ignorance of the fundamental principles of the science of metrology.

This is especially true of the testimony of Mr. C. C. Stutz who, born in Italy of Swiss parents, seems to have been thought particularly fit to be chosen as the representative of the opposition, being the secretary of the American Institute of Weights and Measures, an organization created, as the secretary declares, "for the purpose of defending the existing American system of weights and measures against pro-metric propaganda,"—and also for the improvement of the same, though evidence of the latter objective seems yet to be forthcoming.

Mr. Stutz is especially agitated because, as he says, "the impression has been spread throughout the United States and abroad that the meter and not the yard is the legal standard here"—discussing that question at great length on pages 173-4-5-6 and again pages 318-19-20 of the Report of the Hearings. He creates an imaginary American "inch," contending that it is exactly the same as the English inch and hence the English yard and the American yard are identical.

In reference to this particular part of Mr. Stutz's voluminous testimony the statement of a few facts that are well known to most metrologists may be useful.

The constitution of the United States declares that Congress shall have power "to fix the standard of weights and measures," but Congress has never exercised that power, except in a few isolated instances, the most important being the adoption of the decimal system for the coinage and currency of the United States in 1785—with the subsequent adoption in 1828 of a material standard "troy

pound" for the regulation of the coinage, and the "act to define and establish the units of electrical measure," which became a law on July 12, 1894.

The failure of Congress to act when the importance of action was especially urged by Washington in a message to the first Congress, as it was later by Jefferson, Madison and Adams, was due to the general recognition of the unscientific character of the clumsy and burdensome system or systems then in use in the colonies (mostly derived from the then very imperfect English system) and a strong desire on the part of the "early fathers" (who seem at this distance to have been as wise as they were early) to put into our weights and measures the same simplicity of decimal ratio that has made our system of currency the best in the world.

In the absence of congressional action many of the states acted separately, establishing their own standards, thus creating much confusion. Some states took no action at all, the business of exchange of commodities by weight and measure being based upon units that had no authority except tradition and continued use.

In the mean time important work was to be done by the government itself, in which standards of authority and precision were required. By far the greater part of this, the collection of revenue and the survey of the coasts and the country as a whole, was under the jurisdiction of the Treasury Department, and to a bureau of this department, the Coast and Geodetic Survey, was assigned the duty of obtaining and caring for such standards of precision as could be obtained in Europe.

Among them was a brass bar, eighty-two inches in length, made by Troughton, of London, which was graduated in inches and tenths with a degree of accuracy probably as high as was at that time attainable. A careful examination of the divisions, however, revealed a considerable degree of irregularity, but it was finally decided (1830) that when the temperature of this bar was sixty-two degrees Fahrenheit the distance between the twenty-seventh and the sixty-third inch lines should be regarded as the standard yard by all of the various government bureaus in which measures of length were used.

It is important to note that there was no congressional action, no law passed, the fixing of this standard being done by the secretary of the treasury, on the recommendation of the superintendent of the coast survey, acting in the capacity of superintendent of weights and measures.

Its authoritative use, therefore, was restricted to operations in which the United States government was concerned. At the same time, as the result of the discovery of great discrepancies among the weights and measures actually in use at the principal custom houses, standards of mass and volume were established, the validity of which was restricted in the same way.

In order to reduce the confusion of standards in and among the several states, in 1836 the secretary of the treasury caused a complete set of all weights and measures adopted for use in the collection of revenue to be delivered to the governor of each state, hoping that through their adoption by state legislatures a good degree of uniformity might be secured. In many cases this followed and in some instances the treasury standards were accepted without legislation.

To recur now to the standard yard as represented on the Troughton scale, and its relation to the English standard: It was doubtless a copy, though not an exact copy, of what had been adopted by the English parliament in 1826 as the imperial yard of Great Britain. This was a bar on which the yard was engraved, made in 1760 by a mechanician named Bird and kept in the custody of the clerk of the House of Commons.

In 1834 the burning of the Parliament House destroyed this and other imperial standards stored therein, and thus the immediate ancestor of the Troughton scale disappeared.

It was found impossible to reproduce it with any degree of accuracy by finding the period of vibration of a pendulum as had been originally provided and recourse was had to several copies of it which had been made and

deposited elsewhere. In this way was created the imperial yard which is at present the standard of length in Great Britain.

Here, therefore, are two outstanding facts: First, assuming for the moment that the Troughton scale has some legal standing as a standard yard of the United States, it is *not* a copy of the standard yard of Great Britain and it is well known that it is not in agreement with that standard. Hence our inch can not be the same as the English inch.

Second, the Troughton scale has not and never had legal standing as a standard of length, authoritative over the whole country, and furthermore, it may be well to repeat that Congress has never passed an act to establish a standard yard or a standard inch, except indirectly, as will be explained later.

Thus the claim made by Mr. Stutz and his followers that the inch of the United States is identical with that of Great Britain has no foundation whatever in fact.

The use of the metric system of weights and measures throughout the United States was legalized by act of Congress in 1866 and it is an interesting fact that it is thus far the only general system of weights and measures that has full legal (though not compulsory) standing throughout the whole country.

The history of the so-called "Mendenhall Order" which seems to be so disturbing to the peace of mind of Mr. Stutz and others opposed to metrological reform is briefly as follows: a copy of what is known as the "Metre of the Archives" and also a copy of the kilogramme, both of platinum, came into the possession of the Coast Survey in 1821, through the interest of Albert Gallatin, and as years passed other standard measures were added to the collection, including copies of the imperial yard. The inferior character of the earlier standards as compared with those of later date led to the practical abandonment of their use wherever work of the highest degree of precision was attempted. Every metrologist knows that a material standard may have the backing of legal authority and at the same time be so crude and imperfect as to be useless for refined work.

Without going into the history of the International Bureau of Weights and Measures and the production of beautiful copies of the international standards, it is sufficient to say that on the receipt of the two copies allotted to the United States it was resolved to formally abandon the Troughton scale as a standard of length and adopt the international metre as the final standard of reference, for only in this way could work of high precision then being done in the United States (this included not only the operations of the Coast and Geodetic Survey and other bureaus of the government but practically all research work done at colleges and universities or by independent scientific workers) be "tied up" with that done in Europe, for even in England the metric system was and still is in universal use among scientific men.

In recognition of the really great importance of the event, it was arranged to have the seals (which had been put upon the containers of these standards before they left Paris) broken by the President of the United States.

This was done in the cabinet room of the executive mansion on the second of January, 1890, in the presence, also, of the Secretary of State and the Secretary of the Treasury, together with a number of invited guests, representatives of engineering and scientific societies and others especially interested in the science of metrology.

Thus Metre No. 27 and Kilogramme No. 20 were formally adopted as the national prototype metre and kilogramme.

In connection with the World's Fair in Chicago in 1893 there was held an International Electric Congress, associated with which was a "Chamber of Delegates" officially organized for the purpose of coming to an international agreement upon the definitions of units for electrical measure.

In view of the probable success of this movement and of the certainty that such definitions would be built upon a metric foundation, it was deemed wise to have definite recognition of these national prototypes as the fundamental standards of reference in all metrological operations in which the United States Government was concerned.

This was accomplished by the preparation and publication of Bulletin No. 26 of the Coast and Geodetic Survey, which became authori-

tative on the approval of the Secretary of the Treasury which it received on April 3, 1893.

The "bull's eye" of that announcement is found in the following sentence: "In view of these facts and the absence of any material normal standards of customary weights and measures, the office of weights and measures, with the approval of the Secretary of the Treasury, will in the future, regard the international prototype metre and kilogramme as fundamental standards, *and the customary units, the yard and the pound, will be derived therefrom* in accordance with the Act of July 28, 1866."

Mr. Stutz in his testimony before the committee quotes this sentence several times, referring to the last phrase, "in accordance with the Act of July 28, 1866," as evidence that the metre and kilogramme are not thus made fundamental units but are to be considered as dependent upon the inch and the pound, according to his personal interpretation of the Act of 1866. But by some unhappy chance, by accident or otherwise, he has invariably omitted the words italicised above, "the customary units, the yard and pound, will be derived therefrom," which nullify and completely reverse his argument.

His quotations are apparently made from a circular, No. 47 of the Bureau of Standards in which, according to his own words, it was not intended to reproduce the order as a whole. It is possible, therefore, that these very important words were omitted in that circular and Mr. Stutz shall have the benefit of the doubt, but if he had consulted the original order he would have found them.

There can be no doubt of their meaning and it is a fortunate thing that the legal relations established by the Act of 1866 are so very nearly correct that for all ordinary purposes of comparison (and there can be no other) they are sufficiently accurate.

Recalling the fact that when this Act was passed Congress had never defined the yard or the pound (except the Troy pound for use in the mint); that these words had, throughout the country as a whole, no definite meaning; and the further fact that at that time the metric system of weights and measures was in almost universal use, except in Great Britain and the United States, and that it was represented by precise material standards, it seems more probable than otherwise that the Act of 1866 itself put the country upon a metric basis, supplemented and completed as it was by the receipt and adoption in 1890 of the national prototypes.

In any event there can be no possible doubt as to the effect of the issue of Bulletin No. 26 in making them the fundamental standards for all metrological operations in which the national government is in any way concerned.

The opponents of the metric system are strangely silent regarding another Act of Congress, much more far-reaching and vastly more effective in putting the country upon a metric basis than anything which preceded it.

It is the Act of July 12, 1894 which defines the units of measure by means of which transactions amounting to many hundreds of millions of dollars annually are adjusted, furnishing the sole method of measuring output and consumption of one of the very largest and most important industries of the present day. No one has had the courage to suggest a revision or repeal of that Act, so as to put into it the sacrosanct inch and one of the numerous pounds, in place of the centimetre and the gramme. Watt, kilowatt, volt and ampere are now familiar terms. The great war produced an almost universal interest in metric units and caused many manufacturers to regret that their use had not been made compulsory long ago.

And now space above and around us is almost constantly disturbed by waves, the length of which, measured only in metres, is of vital interest to tens of thousands of people, old and young, rich and poor, who are finding out what a metre is and what goes with it, so that, take it all in all, it seems certain that the opponents of metrological reform are engaged in a hopeless task.

In their own words, "they have beaten it once," and perhaps they may beat it again, *but not many more times.*

T. C. MENDENHALL

RAVENNA, OHIO
SEPTEMBER 2, 1922

SCIENTIFIC EVENTS

THE HERSCHEL CENTENARY

WILLIAM HERSCHEL died 1822 August 25. A hundred years later a party of Herschels of the third, fourth and fifth generations, astronomers and members of the Slough Urban Council made a pious pilgrimage to Upton Church, Slough, where he lies buried; and, after lunching together at the Crown Hotel, which once formed part of William Herschel's property, proceeded to Observatory House—in which two of his granddaughters still live,—where they saw many manuscripts and the other relics of the great astronomer. They saw, for instance, the copy of Locke "On the Human Understanding," the first English book he purchased in order to study our language; and they saw also Caroline Herschel's "Bills and Receipts of My Comets," which was her manner of labeling papers relating to her cometary discoveries; they saw a piece of the old 40-foot tube, and one of the 4-foot mirrors made for it, and discussed with Miss Herschel the possible whereabouts of the other mirror, which may be buried in the garden, and still to be excavated. It is wonderful to think how Herschel's work, old though it is, touches our modern work almost at every point. If we take the half-dozen great advances mentioned by Professor Eddington in his centenary address to the Royal, we are reminded by the measurements of stellar parallax how Herschel's attempts in this direction led to the recognition of binary stars; the discovery of Neptune depended essentially on Herschel's previous discovery of Uranus; one of the early uses made of the spectroscope was to confirm Herschel's view of the gaseous nature of nebulæ; in photography the first glass negative was taken by his own son, and the subject was the scaffolding of his great 40-foot, and even in our modern advances the two-stream hypothesis is only a development of Herschel's investigation of the sun's movement among the stars; and the measurement of the disc of Betelgeuse reminds us not only of his careful scrutiny of objects for any signs of a disc, but of his investigations in optics and his splendid engineering work in the making of great telescopes. How he would have enjoyed himself in the great factory at Mt. Wilson, or discussing problems of cosmogony with the mathematicians of today! Undoubtedly he was a great man, and it was fitting that his memory should be thus honored, so soon after the centenary of the society which had the honor of having him for its first president.—From an Oxford Note-Book in *The Observatory*.

AMERICAN ORNITHOLOGISTS' UNION

THE fortieth stated meeting of the American Ornithologists' Union will convene in Chicago, from October 24 to 26. The public meetings will be held in the lecture halls of the Field Museum of Natural History, from 10 A.M. until 4:30 P.M. each day.

The reading of papers will form a prominent feature of the meetings. All classes of members are earnestly requested to contribute, and to notify the secretary before October 15, as to the titles of their communications, and the length of time required for their presentation, so that a program for each day may be prepared in advance.

Business sessions will be held at the University Club of Chicago. Public sessions will be held in the Field Museum of Natural History, Roosevelt Road and Lake Michigan. Hotel headquarters will be at the Auditorium Hotel. According to custom, a dinner will be held on Wednesday evening, October 25, for fellows, members, associates and guests. Luncheon will be served daily at 1 P.M. in the museum, October 25, 26, 27. On Friday, October 28, an excursion will be conducted to the Indiana Sand Dunes, fifty miles southeast of Chicago. Particulars in regard to these features will be found at the registration desk on the opening day.

An exhibition of bird paintings and photographs will be held in connection with the meeting, to which every one is invited to contribute. Original paintings, drawings and sketches in color or black and white are desired, not only from the artists, themselves, but from owners who may be willing to loan them.

PUBLIC LECTURES AT THE CALIFORNIA ACADEMY OF SCIENCES

THE California Academy of Sciences announces a course of six free public lectures on the general subject of "Science and Health," to

be given at three o'clock on Sunday afternoons, in the auditorium of the Academy's Museum in Golden Gate Park, San Francisco, as follows:

October 1. The Experimental Method in Animal Psychology: Dr. Samuel J. Holmes, professor of zoology, University of California.

October 8. Equilibration of Animals and Aviators: Dr. Samuel S. Maxwell, professor of physiology, University of California.

October 15. The Use of Animals in the Diagnosis and Prevention of Disease: Dr. Carl A. L. Schmidt, associate professor of biochemistry, University of California.

October 22. Animal Experimentation: Dr. T. D. Beckwith, professor of bacteriology, University of California.

October 29. Animal Foes of the Human Body and How to Control Them: Dr. Charles A. Kofoid, professor of zoology, University of California.

November 5. What Animal Experimentation Has Done for Childhood: Dr. E. C. Fleischner, clinical professor of pediatrics, University of California.

These lectures are all masters in their respective subjects. What they have to say will not only be authoritative and up to date, but will be presented in a popular and convincing manner. These lectures, which will be illustrated, are offered by the California Academy of Sciences, free to the public, as one of the several educational activities in which it is engaged.

THE SILLIMAN LECTURES OF YALE UNIVERSITY

This year's Silliman Memorial Lectures at Yale University will be delivered by Dr. August Krogh, professor of zoophysiology in Copenhagen University. Professor Krogh has taken for his general topic "The Anatomy and Physiology of Capillaries," and will speak on the following subjects on the dates given:

October 5: "The Distribution and Number of Capillaries in Selected Tissues. The Evidence of Their Independent Contractility.

October 6: "The Histological Structure and Innervation of the Capillary Wall."

October 9: "The Reactions of Capillaries to Stimuli. The Hormonel Control of Capillary Circulation."

October 10: "The Mechanism of Some Capillary Reactions, especially in the Human Skin."

October 11: "The Exchange of Substances through the Capillary Wall."

October 12: "Some Problems of Capillary Physiology and Pathology."

Professor Krogh has a large amount of entirely new material to present which should prove of importance to all those branches of science which concern the circulation of the blood. At the time of the award of the Nobel Prize to Dr. Krogh in 1920 his work on capillaries was regarded as only beginning, and since that time his researches in this field have been pushed ahead with rapidity and success. The results of these researches will be made public for the first time in the Silliman lectures.

In a recent article in *The Scientific Monthly*, Dr. W. R. Miles, of the Nutrition Laboratory of the Carnegie Institution of Washington, gave the following résumé of Dr. Krogh's career to date:

Dr. Krogh is scarcely forty-five years old. He received his educational and scientific training in Denmark and is a son of whom that country can well be proud. For a number of years after receiving his degree and serving as laboratory assistant to Professor Christian Bohr no suitable teaching or research position opened to him in Denmark. However, he refused to accept such a position in any other country. He made two expeditions to Greenland, the first to study the tension of carbon-dioxide in ocean water and the second to investigate the respiratory metabolism of the Eskimos. Thus, without any laboratory facilities, he literally plunged into research. A study on the expiration of free nitrogen from the body was recognized as so important as to receive the Seegen Prize of the Imperial Academy of Sciences in Vienna. He was appointed a lecturer in physiology under the science faculty of the Copenhagen University in 1908 and was provided with a small laboratory in the fall of 1910. It is in this laboratory that most of his scientific work has been done. A visitor will gain the impression that his laboratory facilities are rather meager as regards both room and equipment and that he does not have adequate assistance. Certainly it would be a most worth while investment to provide such a man with all the assistance he can comfortably direct. His researches have covered a wide range and have been singularly concise and complete. He is a master technician, a

scientific explorer by nature, a skilled interpreter and critic of scientific facts, and he has much facility in writing. Most of his recent work is published in English. About his personality there is a quiet humility which strongly attracts advanced students and begets confidence in Dr. Krogh's scientific results. His mental attitude can well be illustrated by a sentence from a recent letter to an American colleague: "The Nobel award came as a perfect surprise to me and when it was first told me by a journalist, I declined to believe it because, in my opinion, my work on the capillaries was so far only a promising beginning."

APPOINTMENTS AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE Massachusetts Institute of Technology announces a number of additions to its faculty and instructing staff. Chief among these are the appointments of W. Spencer Hutchinson to the professorship of mining, Dr. G. B. Waterhouse to the professorship of metallurgy and Dr. Frederick G. Keyes to be acting head of the department of chemistry.

Professor Hutchinson graduated from the institute in 1892, after having studied in the civil engineering and mining departments. During his career he has examined and managed a number of mining properties in the United States. He is known as an authority on mine valuation and taxation, and has done much professional work in Mexico, South America and Australia. For several years he has been consulting engineer for the Vanadium Corporation of America, which has extensive mines in Peru. He has been a consultant mining engineer in Boston.

Professor Waterhouse was born in England forty years ago, and educated at Sheffield, where he received the degree of bachelor of metallurgy. He came to the United States in 1900, and later studied at Columbia University, where he obtained the degree of doctor of philosophy in 1906. He is the author of numerous original scientific papers and the translator of a great number of French and German works on metallurgy. His specialty is the metallurgy of iron and steel. From 1908 until the present time he has been technical director of the Lackawanna Steel Company in Buffalo.

Professor Keyes, the acting head of the department of chemistry, is a graduate of Rhode Island State College and of Brown University. During the war he was stationed at Puteaux as director of the Research and Control Laboratory, with the rank of major in the A. E. F. In 1920 he was made director of the Research Laboratory of Physical Chemistry at the institute, following the resignation of Professor A. A. Noyes. A short time ago Professor H. P. Talbot resigned as head of the department of chemistry to become dean of students on the retirement of Professor Burton, and Professor Keyes was appointed as acting head of the department until Professor Talbot's permanent successor is chosen.

SCIENTIFIC NOTES AND NEWS

AT the Hull meeting of the British Association, Mr. F. E. Smith, director of scientific research at the Admiralty, and secretary of the Physical Society, was elected one of the general secretaries, to succeed Professor H. H. Turner, of the University of Oxford. Professor J. C. Shields and Professor J. C. McLennan presented the invitation to meet in Toronto in 1924, which was accepted. It was announced that a grant of about $50,000 would be available for the meeting and for defraying the expenses of visiting members.

PROFESSOR J. H. JEANS, secretary of the Royal Society, who was professor of applied mathematics at Princeton University from 1905 to 1909, received the doctorate of science from Oxford University on the occasion of his delivery of the Halley lecture.

PROFESSOR E. T. WHITTAKER, formerly royal astronomer for Ireland and secretary of the Royal Astronomical Society, has been elected a foreign member of the Reale Accademia dei Lincei.

THE honorary degree of doctor of science has been awarded by the University of Leeds to Professor A. F. Holleman, of the University of Amsterdam.

IN recognition of the notable services rendered by Dr. Bernhard E. Fernow to forestry in America, the trustees of Cornell University have given the name Fernow Hall to the uni-

versity building devoted to instruction in forestry. The formal unveiling of the tablet bearing Dr. Fernow's name took place October 5, when addresses commemorative of his achievements were delivered by Dr. Livingston Farrand, president of the university, Dean Albert R. Mann, of the New York State College of Agriculture, and Professor Ralph S. Hosmer, head of the department of forestry. Dr. Fernow organized at Cornell University in 1898 the first school of forestry in America.

AT a recent meeting of the corporation of Yale University a letter was presented from Dr. Lawrason Brown, president of the National Tuberculosis Association, in which appreciation was expressed of the work of Professor Treat B. Johnson and Mr. Elmer B. Brown, who had been associated with Dr. Esmond R. Long, of the University of Chicago, in research in the fundamental nutrition of the tubercle bacillus. The corporation passed a vote of thanks to the National Tuberculosis Association for its further appropriation for the work in which Professor Johnson and Mr. Brown will continue to be associated.

THE Treasury Department has announced that Dr. J. W. Scherechewsky, assistant surgeon general, U. S. Public Health Service, has been commissioned to conduct an investigation into the cause of cancer; the headquarters of this investigation will be established in Boston.

PROFESSOR H. B. MERRILL, of Carroll College, has resigned to take up chemical work in the research laboratory of the A. F. Gallun & Sons Company, Milwaukee.

DR. A. R. FORTSCH, of the Iowa State University, will become research chemist in the laboratory of the Standard Oil Company at Whiting, Indiana.

AN Associated Press despatch from Honolulu, dated September 20, states that, as the result of burns received while experimenting with radium, Dr. Hideljich Kinoshita, professor of science at the Imperial University of Tokyo, may lose his eyesight.

THE governors of the Harper Adams Agricultural College, Newport, England, have accepted with regret the resignation of Mr. P. Hedworth Foulkes, who has held the post of principal since the opening of this college twenty-two years ago.

GEORGE A. SEAGLE, who had been for thirty-eight years superintendent of the Wytheville (Va.) station of the Bureau of Fisheries, has retired from active service.

MR. W. H. FRY, petrographer in the Bureau of Soils, U. S. Department of Agriculture, for a number of years past, has resigned and will remove to Fayetteville, N. C.

DR. O. A. REINKING has resigned from the University of the Philippines to take a position as plant pathologist, in Honduras, for the United Fruit Company. Dr. Reinking recently received his doctorate at the University of Wisconsin, where he has continued researches, begun in the Philippines on coconut bud-rot. He obtained leave from the University of the Philippines about a year ago and returned to this country by way of British North Borneo, Java, Italy, Germany, France and England, visiting mycological and pathological institutions.

DR. BARTON WARREN EVERMANN, director of the Museum of the California Academy of Sciences and of the Steinhart Aquarium, has been appointed by the National Research Council as its representative at the Commercial Conference to be held at Honolulu from October 25 to November 8, under the auspices of the Pan-Pacific Union, where he will present a paper on "The Conservation of the Marine Life of the Pacific." Dr. Evermann will sail for Honolulu on the *Maui* on October 18.

PROFESSOR S. R. WILLIAMS, head of the department of physics of Oberlin College, has been granted a year's leave of absence and will spend the year in research work at the California Institute of Technology as research associate.

PROFESSOR GEORGE GRANT MACCURDY has returned to Yale University after a year's stay abroad as first director of the American School in France for Prehistoric Studies.

DR. ALONZO E. TAYLOR, of Stanford University, sailed for Europe on September 23.

ACCORDING to English journals, an expedition headed by Captain F. Hurley has left

Sydney for Port Moresby with the object of exploring New Guinea from the air. The party includes an ethnologist and a naturalist. Two seaplanes are being taken and will be used in a four months' air survey of the western portions of British New Guinea. Meanwhile the scientific section of the expedition will navigate the Fly River in a ketch. The cost of the seaplanes is being borne by Mr. L. Hodson, of Sydney.

THE courses offered by the New School for Social Research, New York City, include "The Significance of Modern Philosophy," by Professor John Dewey, Columbia University; "Behavior Psychology," by Dr. John B. Watson, of the J. Walter Thompson Company; "Psysiology and Conduct," by Professor Arthur R. Moore, of Rutgers College, and "Biology and its Social Implications," by Professor Otto Glaser, of Amherst College.

THE Harveian Oration will be delivered before the Royal College of Physicians of London by Dr. Arnold Chaplin, on October 18. The Bradshaw Lecture will be delivered by Sir Maurice Craig, on "Mental symptoms in physical disease," on November 2. The Fitz-Patrick Lectures will be delivered by Dr. R. O. Moon, on "Philosophy and the post-Hippocratic school of medicine," on November 7.

A CELEBRATION of the one hundredth anniversary of the birth of Louis Pasteur will take place in Philadelphia on December 27. Tentative plans call for a meeting in the afternoon at the Academy of Music, and a banquet in the evening at the Bellevue Stratford Hotel, at both of which there will be distinguished speakers. A general committee, comprising Drs. Edgar Fahs Smith, Ernest Laplace, Francis X. Dercum, Charles A. E. Codman Wilmer Krusen, McCluney Radcliffe, secretary, Judson Daland, treasurer, and William Duffield Robinson, chairman, and an honorary advisory committee from all parts of the country have been appointed.

DR. ALICE ROBERTSON, for several years professor of zoology in Wellesley College, known for her work on the Bryozoa, especially of the Pacific Coast of North America, died at Berkeley, California, on September 14. Although Dr. Robertson had not been in good health for several years, she had kept at her scientific work, and death followed a sudden illness, which a surgical operation failed to relieve.

MISS MARY A. BOOTH, formerly editor of *Practical Microscopy,* has died at her home in Springfield, aged seventy-nine years. She was a member of the American Microscopical Society, the New York Microscopical Society, and the Brooklyn Institute of Arts and Sciences and a fellow of the American Association for the Advancement of Science and of the Royal Microscopical Society of London, England.

DAVID SHARP, F.R.S., formerly curator of the Museum of Zoology at the University of Cambridge and editor of the *Zoological Record,* died on August 27, at the age of eighty-one years.

TADEUSZ GODLEWSKI, professor of physics in the School of Technology at Lwów, has died at the age of forty-four years. He is known for his work on radioactive and electrochemical problems.

DR. T. ICHIKAWA, president of Momoyama Hospital, Tokio, died on September 19 from typhoid fever contracted while experimenting with typhoid serum.

THE organization founded to promote the welfare of the University of Bonn has endowed the university with an institute for research with the roentgen rays. Professor Grebe is in charge and it is expected that the institute will be inaugurated this fall.

A SCIENTIFIC conference on problems relating primarily to the Pacific region will be held in Australia during August or September of next year. Plans are now being made for this event by the Australian National Research Council, supported by a commonwealth grant of £5,000 under the leadership of Professor Sir T. Edgeworth David. This will be the second conference on Pacific problems. The first was organized by the Committee on Pacific Investigation of the American National Research Council and met in Honolulu in August, 1920. The scientific men and scientific agencies interested in studies of the Pacific have not yet

formed any definite organization except a committee which has acted informally to facilitate continuity of effort. Although some form of organization may be adopted at the meeting in Australia, it is expected that each conference will be autonomous and independent and that the organization and program for each conference will be in the hands of the country that issues the invitation.

WE learn from *Nature* that the centenary of the Yorkshire Philosophical Society, which was founded in 1822, was celebrated on September 20. The members of the society and its guests were received in the gardens of the Yorkshire Museum by the president, Mr. W. H. St. Quintin, and a number of congratulatory addresses from national as well as local learned bodies were read by the representatives. Later, the gathering went in procession to the Minster, where a short service was held and an address delivered by the Bishop of Beverley.

THE third international conference of "Psychotechnique appliqué à l'orientation professionnelle" will meet this year at Milan on October 2 to 5. According to the announcement there were to be discussions on the following subjects: (*a*) What is meant by vocational aptitudes? (Lahy); (*b*) Natural aptitudes and acquired aptitudes (Décroly, Patrizi); (*c*) The psychological analysis of work (Gemelli, Lipmann); (*d*) Vocational guidance and Taylorism (Bauer); and (*e*) An international unification of tests and individual ratings (Claparède, Mira, Myers).

A HEALTH survey of the printing trades has been authorized by the International Joint Conference Council, representing both employers and employees. The survey is intended to cover two years and will be nation-wide. The work will include a thorough study of printing processes in their relation to health and of printing house conditions, possibly more or less detrimental to health and life. The investigation will be carried on in cooperation with a large number of governmental, scientific and corporate organizations, including the United States Bureau of Labor Statistics, which will have charge of the major portion of the social and economic inquiries. A large measure of cooperation is expected from the insurance companies, but especially from Harvard Medical School, Yale Medical School, the Public Health School of Johns Hopkins University and a number of state health and labor departments. Particular emphasis will be placed upon methods of ventilation, air-pollution, lighting, eye-strain, posture and physique. The investigation will be under the immediate direction of Dr. Frederick L. Hoffman, dean of the advanced department of the Babson Institute, Wellesley Hills, Massachusetts, and consulting statistician to the Prudential Insurance Company of America.

WE learn from the London *Times* that the Rowett Institute of Research in Animal Nutrition, which is conducted by a joint committee of representatives of the University of Aberdeen and the North of Scotland College of Agriculture, was opened by Queen Mary on September 12. The buildings forming the institute are situated about a mile from Bankhead, Aberdeen. The capital outlay on the scheme was about £50,000. Of this sum the Treasury, on the recommendation of the Development Commission, promised £20,000 provided an equal sum was obtained from other sources. At this stage Mr. John Quiller Rowett, LL.D., who has shown great interest in scientific research, offered £10,000 to allow the work of building the institute to proceed. Impressed with the necessity of leaving the institute room for expansion, Dr. Rowett made a further offer to provide, in addition to his first generous gift, sufficient funds to purchase the farm of Bridgefood and the croft of Redpool. The institution has been organized to include departments dealing with physiology, biochemistry, bacteriology and pathology, and to have an animal husbandry department, which is carrying out feeding and other experiments on a practical scale. All these departments afford mutual assistance to each other, and all the work, both purely scientific and practical, is organized from the newly built center. The director of the institute is Dr. J. B. Orr.

THERE is given in *Nature* some further information concerning the meeting of the Commission on Intellectual Cooperation of the

League of Nations which held its first session at Geneva from August 1 to 5. The commission had been given a free hand to define its own program with due regard to existing national activities and existing organs of international intellectual life. The following were among the topics selected for consideration: the desperate economic condition of the *intelligenzia* in some European countries—notably Austria and Poland; the protection of proprietary rights in scientific discoveries and ideas; the establishment of an international *entente* for the examination and publication of archeological monuments; inter-university relations; and an international organization of bibliography. All these questions have been referred to individual members of the commission or to sub-commissions for the preparation of reports with the view of taking further action. As for cooperation in scientific research, the commission, anxious not to interfere in the organization or work of the scientific societies, decided that this should be left to the initiative of the societies themselves. Another question on which the commission found itself unable to take any useful action was the publication by common consent of workers in all parts of the world of discoveries relative to toxic gases and the development of chemical warfare. It decided to reply to the reduction-of-armaments commission, which had referred the question, that it was unable to suggest methods whereby this result might be brought about.

UNIVERSITY AND EDUCATIONAL NOTES

MR. JAMES B. DUKE has given $1,125,000 to Trinity College. The gifts include $1,000,000 to the college endowment fund, $25,000 to the new gymnasium, $50,000 towards a $100,000 law building and $50,000 toward a $100,000 building for the new school of religious training.

DR. WORTH HALE, assistant dean of the Harvard Medical School, has been appointed acting dean to serve during Dr. David L. Edsall's absence in Europe during the first half year; Dr. Roger I. Lee will serve as acting dean of the School of Public Health.

DR. JOHN M. T. FINNEY has been appointed temporary surgeon-in-chief of the Johns Hopkins Hospital and professor of surgery in the medical school, in place of the late Dr. William S. Halsted. The faculty will appoint a committee to make a permanent selection.

DR. L. A. PECHSTEIN, director of the department of psychology and education of the University of Rochester, has been appointed dean of the College for Teachers of the University of Cincinnati, to succeed Dr. W. P. Burris.

THE psychology department of the Ohio State University announces the following additions to its staff: Herbert H. Goddard, full professor; Robert D. Williams, assistant professor; Marjorie Bates, instructor. The following promotions have also been made: Harold E. Burtt to full professor; A. Sophie Rogers to assistant professor.

RICHARD C. LORD, Ph.D. (Washington and Lee), for some time engaged in industrial chemistry, has been appointed assistant professor of chemistry and physics in Kenyon College.

DR. F. I. WERTHEIMER, recently connected with Professor Kraepelin's clinic at Munich, has become a member of the staff of the Henry Phipps Psychiatric Clinic at the Johns Hopkins Hospital.

THE Council of University College of North Wales has appointed Professor David Thoday, of the South African University, Cape Town, to the chair of botany, in succession to Dr. Phillips, who retires after thirty-eight years' service.

DR. GEORGE HASWELL WILSON, lecturer in bacteriology at the University of Glasgow, has been appointed to the chair of pathology in the University of Birmingham, rendered vacant by the election of Professor J. Shaw Dunn to the corresponding post in the University of Manchester.

DISCUSSION AND CORRESPONDENCE

THE DEATH RATE FROM TUBERCULOSIS

TO THE EDITOR OF SCIENCE: About a year ago, I had occasion to request of the chief

executive of one of our important health departments, information upon the incidence of tuberculosis in his state for the past decade. In his reply he stated, among other things, that recently there had been a very marked and quite inexplainable decline in the tuberculosis death rate. The statement struck me as singular, for it is difficult to conceive of a sudden, conspicuous decline in the death rate of a disease of the nature of tuberculosis, without a reasonable explanation for it. A very brief search for an explanation soon revealed the fact that the experience of the particular health officer to whom I had written was not peculiar to his state, but was demonstrable for practically all our registration states, as well as for the most of our larger centers of urban population.

If one will chart by years the mortality rates for tuberculosis for a period covering the past fifteen or twenty years, for almost any of our states or cities that keep correct records and that have been active in the suppression of tuberculosis, it will be seen that in the main there was a steady decline until 1917 and 1918. During 1918 and 1919 there was a sharp upward trend to the curve, followed in a year, or at most two years, by a marked downward direction of the curve—much steeper in its descent than that preceding 1917-1918. With a number of such charts before one, the reason for the recent decrease in the death rates from tuberculosis becomes obvious. The pandemic of influenza of 1918-19 carried off, in a brief period, a large number of tuberculosis subjects that would otherwise have lived on and their deaths been so distributed through later years as not materially to have disturbed the uniform downward direction of the tuberculosis curve that preceded the period of the great pandemic.

From the standpoint of results, advantageous to the race alone, and disregarding all humane considerations, this may be viewed as the beneficent influence of a great plague. The least resistant of the population succumbed, those more resistant and physically better fitted to survive, did so. The human material thus left is probably the most promising that has existed for generations, in so far as the permanent lessening of tuberculosis among it is concerned; and we can expect that the curve for tuberculosis death rates in the future will be for a time much more sharply downward than ever before, and that its average level for a number of coming years will be much lower than that preceding the epidemic of influenza, providing, of course, there is no abatement of those widespread activities that have been so instrumental in lessening the incidence of the disease in the past.

For the anti-tuberculosis worker, the present appears to offer a golden opportunity.

A. C. Abbott
School of Hygiene and Public Health,
University of Pennsylvania

OLD GLACIATION IN THE CORDILLERAN REGION

To the Editor of Science: The communication by Thomas Large on the above subject in the September 22 issue of Science prompts me to write that in 1916 I found till with striated boulders and pebbles in the brickyard near the normal school at Cheney, Washington, beyond the limits here reported by Large. I brought this matter to the notice of the Geological Society of America at the Albany meeting in December, 1916, and the following brief statement concerning it appears in the proceedings of that meeting (*Bull. Geol. Soc. America*, Vol. 28, p. 143):

In northern Washington the occurrence of a very old drift, probably Kansas, was established by the discovery of till and striated stones on a high divide southwest of Spokane, in the vicinity of Cheney. Boulders had been observed in this region, and the possibility of glaciation had been suggested by M. R. Campbell in the Northern Pacific Guide Book.

Frank Leverett
Ann Arbor, Michigan,
September 25, 1922

SOME SIMILARITIES BETWEEN THE GEOLOGY OF CALIFORNIA AND PARTS OF THE DUTCH EAST INDIES

If we compare the Sierra Nevada with the Malay Peninsula, the Coast Range with the Barissan Mountains of West Sumatra and the great valley of California with the plains of East-Sumatra, it is obvious that the topograph-

ical similarities are attended with geological ones. In the Malay Peninsula as well as in the Sierra Nevada granitic rocks of about the same Mesozoic age have a great extension. The original cover of these rocks has disappeared during the succeeding periods by long erosion and the erosion products fill up the geosynclinal basins of East-Sumatra and the valley of California, which both are characterized by important oil deposits of Tertiary age. And to the west young mountain ranges, in which strong earth movements still continue, have separated the geosynclinal basins from the ocean.

In the Dutch East Indies important transversal and diagonal fractures occur near the bending points of the horizontal projection of the geanticlinal axes. In the western mountains of North America striking examples of the same kind are found. Several depressions of the geanticlinal axes along which transcontinental railroads cross the mountain ranges, can be compared with straits near the bending points of the East Indian rows of islands. For instance, the traveler, who approaches the Sierra Nevada from the desert region on the Santa Fé route, can reach the Pacific coast along transversal and diagonal fractures, which exist near the bending points between the Sierra Nevada and the San Bernardino range.

H. A. BROUWER

DELFT, HOLLAND,
SEPTEMBER, 1922

RELIEF FOR RUSSIAN SCIENTIFIC MEN

THE "Friends of Russian Scientists," an organization sponsored by a hundred professors and social workers in and around Boston, for the purpose of raising contributions to be known as the Gorki Fund for the Relief of Russian Scientists, has just received the following letter from Maxim Gorki:

In reply to your letter let me make the following statement: "The House of Scientists" in Petrograd is a charitable organization for mutual benefit, founded by Petrograd professors. I have the honor to be its chairman. The full name of the organization is "Committee for the Betterment of the Condition of Scientists" (Kommissia Ulutschenia Bita Utschenich — abbreviated: KUBU). Address: C. Oldenburg, Member of the Academy, House of Scientists, 27 Millionaia, Petrograd.

The "House of Scientists" brings together all the scientific workers of Petrograd—there are about 3,000 of them, and together with their families they comprise about 12,000 souls. They are undergoing great privation, and are in particular need of sugar, flour and fats.

Most of the scientists are men of middle or advanced age, enfeebled by years of undernourishment and the numerous worries of present day life in Russia.

A ten dollar "A. R. A." parcel is a great help. The work of the American Relief Administration with Hoover at the head is one of the most brilliant pages in the history of the United States.

It seems to me that there is no need to describe in great detail the extent of misery among the scientists.

Do make every possible effort to sustain at least ten of these precious lives—precious in the broad sense of serving all mankind, the work of science being truly international and universal.

I wish you success in your good work!

M. GORKI

Steringsford, Sept. 1, 1922.

A large section of the American public, which has perhaps grown callous to the continued appeals for relief funds, has cherished the notion that the emergency in Russia is over. Gorki's letter shows that this is not true. Moreover, in a recent communication to the treasurer of the Gorki Fund, Mr. Herbert Hoover says:

There is no question of the need of the Russian intellectuals—they as a class have suffered more than any other class in the Russian debacle. Any funds raised for the relief of these people will contribute to a most worthy undertaking.

If the scientists and educators . . . will contribute to the support of their colleagues in Russia, we know of no more worthy cause to which they can lend their support.

Contributions are being received by Professor H. W. L. Dana, treasurer of the Gorki Fund, 105 Brattle Street, Cambridge, Mass. They are being transmitted to the Petrograd "House of Scientists," the non-partisan body of which H. G. Wells and others have written with enthusiasm, and are in turn distributed to the Russian scientific workers most in need. It may be added that the sums received here for this purpose are forwarded in full to Russia,

since the incidental expenses of printing and postage are being met independently.

Isidore Levitt,
Cambridge, Mass. *Secretary*

QUOTATIONS

THE BRITISH ASSOCIATION

The meeting of the British Association at Hull ended yesterday. It will be remembered chiefly by Sir Charles Sherrington's presidential address, on which discussion did not cease during the week, nor is it more likely to die down when science and philosophy have had time to study the full text. So far as it was a positive statement it was definitely on the materialistic as opposed to the vitalistic interpretation of Nature. It explained the increasing number of mechanisms in the body of men and animals which are now understood, and definitely referred these to the order of chemistry and physics instead of to vague non-material principles. So far, its assault was limited to fashionable doctrines within the sphere of science, and should disturb only those who trace purpose and consciousness back to animalculæ, or attribute a *psyche* to the cells of the liver. With regard to the mind itself no positive statement of a materialistic interpretation was made; on the contrary, Sir Charles Sherrington, with a deliberateness perhaps in itself suggestive, reiterated our complete failure to interpret mind in terms of matter. But the president traced the relations between the evolution of the nervous system and the rise of mind in the animal kingdom with meticulous care, and insisted so coldly but so minutely on the correspondences between what he stated to be mechanism and what all regard as mind that it is at least open to read intention into his argument. No one can doubt but that the British Association, through its president, has fulfilled one of its highest functions this year. It has set men thinking and talking on one of the more fundamental problems that excite the human intelligence.

Otherwise the meeting at Hull was useful rather than distinguished. There were many solid papers, some valuable discussions, and no more than the customary number of attempts to reach the public ear by the methods of exaggeration, or of insistence on the dramatic side of a communication. The debate on nitrogen was a sound and instructive contribution to one of the branches of applied science most vital to the safety and the prosperity of nations. The coming together of zoologists, government officials, fishery experts and members of the fishing industry did much to enlighten both science and industry. We admit with pleasure that since we and others called attention to the diffuse and overloaded nature of the program of meetings of the association, the organization has been notably improved, especially with regard to the arrangement of joint discussions, in which two or more sections take part. Our special correspondents, however, inform us that there were still at the Hull meeting many cases of several papers or discussions of wide interest set down for the same day and hour. Unfortunately, moreover, not a few of the speakers and readers of papers had rudimentary ideas on public speaking, and attempted to cover far too much ground in the time allotted to them, or overloaded their contributions with unnecessary introductory matter. Science should not disdain the art of presentation.—The London *Times*.

SCIENTIFIC BOOKS

Respiration. By J. S. Haldane, M. D., LL. D., F. R. S., Fellow of New College, Oxford; Hon. Professor, Birmingham University. Yale University Press, 1922. 427 pp., 104 figures, and an appendix of analytical methods.

This volume contains the Silliman Memorial lectures at Yale University for 1915, revised so as to bring the presentation of the material up to the date of publication. It is a monograph covering the field of respiration: a field which, largely as the result of the work of Haldane and his collaborators, has assumed outstanding importance in recent years, and promises further important developments in the near future in theoretical knowledge and in practical applications to clinical medicine and industrial hygiene.

In brief, this book is the carefully revised and coordinated presentation, while the author is at the acme of his productive powers, of

the life work of one of the master investigators of our time. It is a fit companion to the volumes from the pens of previous Silliman lecturers, including such names as J. J. Thomson, Sherrington, Rutherford, Nernst, Bateson, and Arrhenius.

It begins with a brief but illuminating account of the historical development of the knowledge of respiration; its relation to chemistry and physics on the one hand, and to the theory of physiological regulation on the other. The chapters following deal with carbon dioxide and the chemical regulation of breathing; the nervous mechanism and control and some of the nervous disturbances of respiration, as in "soldier's heart," neurasthenia and fatigue; the blood as a carrier of oxygen with a discussion of the properties of hæmoglobin and the variations of its dissociation curve; the blood as a carrier of carbon dioxide and the relations of carbon dioxide to neutrality regulation in the blood and other fluid media of the body; the causes and effects of anoxhemia, and the importance and frequency of oxygen deficiency as a factor in functional disturbances; the mutually regulative relations of blood reaction and breathing; the much disputed question of gas secretion in the lungs; the influence of vitiation of the atmosphere upon health in relation to industrial hygiene; high atmospheric pressures and caisson disease; low atmospheric pressures, mountain sickness, and the physiological conditions to which aviators are exposed; and an appendix giving the specialized methods which the author has developed for investigation in this field.

Two general aspects of Haldane's work deserve particular notice: Other master physiologists—formerly Voit, and in modern times, particularly Pawlow—have emphasized the importance of dealing with the normal and complete organism—for example, the conscious, healthy, happy, unanæsthetized, unrestrained dog. It is the failure of the general run of investigators to appreciate and apply this doctrine, and their attempt to infer truth directly from the essentially false conditions of most experimentation—for example, much of the current blood pressure experimentation, and the reduced circulation—which leaves so little value in most of the articles filling our journals. They deal merely (as Haldane incisively expresses it in his preface) "with fragments of frogs and other animals." Haldane, on the contrary, more than any other physiologist has found ways to use as his "versuchstier" not only the normal mammalian organism, with functions unperverted by experimental conditions, but living, conscious, active man. The investigator himself and his collaborators have been the chief subjects of his experiments. Indeed Haldane's demonstration of the possibility and the efficiency of experimentation upon man will probably in the future be accounted his greatest contribution. By no other method apparently could the character and uniformity of the alveolar CO_2 regulation,—the central fact of the Haldanian conception of respiration—have been established.

The second aspect of Haldane's thought which gives it permanent philosophical value is his treatment of respiration and the blood as aspects and illustrations of physiological regulation: that extraordinary power of every living organism to maintain itself, so different from, or rather so much in addition to the equilibrium of an inorganic system. It is the capacity to "preserve constant the conditions of life in the internal environment," as Claude Bernard expresses it.

This conception of "organicism" as the central doctrine of biology differentiates Bernard, Haldane, and others who hold it, from the vitalists on the one hand, and from the mechanists on the other. It prompts the most thorough analysis of which our present day and incomplete chemistry and physics are capable into the physico-chemical conditions and properties of the humors and cells; but it looks on this analysis as merely a preliminary and sees as the essential topic of the physiologist those "living" reactions and processes by which the organism "preserves constant," or rather adjusts, controls, and regulates, within narrow limits of variation such "conditions of life" as osmotic pressure, hydrogen ion concentration, temperature, content of sugar, calcium, and potassium and a thousand other elements already

known, suspected, or yet to be discovered "in the internal environment."

YALE UNIVERSITY YANDELL HENDERSON

SPECIAL ARTICLES

A CASE OF DUPLICATE GENES IN CREPIS CAPILLARIS (L.) WALLR.

THE rosette leaves of *Crepis capillaris* (L.) Wallr. normally have a more or less pronounced pubescence on the lower surface of the midrib. Often the upper surface is also similarly pubescent, but not by any means in all cases, and the significance of this latter difference, if any exists, has not been learned.

In 1918 in a culture which had its origin from wild plants growing in Berkeley there was found a plant ($17.192P_2$) which did not show the pubescence on the lower surface of the midribs of the rosette leaves. When selfed this plant reproduced the type and a strain of "smooth" leaved plants was established. Although there is some variation in the amount of pubescence on the ribs of different plants of the hairy strain, there is no difficulty in distinguishing the two groups.

Crosses between these races at first gave discordant results. More recently with larger cultures and perfected technique data have been collected which indicate that hairiness of the midribs is due to duplicate dominant genes, which are not in the same chromosome group.

Two F_2 cultures in 1921 gave 556 hairy- to 40 smooth-leaved plants, a ratio of 14.926 to 1.073 ± 0.106, which is a very good fit indeed. Among the F_2 plants there should be an equal number giving segregating populations and populations containing only one type of plant. Among those segregating in F_3 half should give 15 : 1 ratios and half 3 : 1 ratios.

Data from F_3 populations are not yet complete but cultures giving both 3 : 1 and 15 : 1 ratios have been obtained from another cross. These results show that the hairy plant used as pollen parent in this case was AABb which gave all hairy in F_1 and equal numbers of 3 : 1 and 15 : 1 populations in F_2. This supplies also the necessary data to satisfy theoretical requirements for the duplicate gene interpretation.

Complete data from crosses involving hairy and smooth characters are reserved for a future publication.

E. B. BABCOCK
J. L. COLLINS
BERKELEY, CALIFORNIA

INHERITANCE OF GLANDULAR PUBESCENCE IN CREPIS CAPILLARIS (L.) WALLR.

THE usual wild type of this species has glandular pubescence on the involucral bracts and extending downward on the pedicel for some distance from the flower head.

In 1918 a single plant appeared which did not have these glandular hairs. Such plants have been designated as "bald." The culture in which this "bald" plant appeared grew from seed sent us from Copenhagen, Denmark. Since this first appearance, "bald" plants have been found in cultures derived from five other geographical locations as follows: England, Sweden, Chile, France and the Azores Islands.

The identity of the gene in all the cultures except that from France has been established by crossing, which in all cases produced only "bald" plants.

The bald character is produced by a single recessive gene. The F_1 plants obtained from crossing bald with glandular were completely glandular. In a culture of 77 back crossed plants 39 were glandular and 38 bald. A total of 210 F_2 plants gave a segregation of 174 glandular to 36 bald, the ratio being 3.314 : 0.685. The deviation in this case is 3.89 times the probable error. The major part of this deviation is due to one culture which produced 72 glandular to 2 bald plants. When this culture is excluded from the totals, there then remains 102 glandular to 34 bald, which is an exact 3 : 1 ratio. The F_2 bald plants which were tested bred true in F_3. Only two glandular F_2 plants have been tested, both segregating in F_3.

Detailed data for all bald cultures will be given in a future publication.

E. B. BABCOCK
J. L. COLLINS
BERKELEY, CALIFORNIA

THE AMERICAN CHEMICAL SOCIETY

THE sixty-fourth gentral meeting of the American Chemical Society was held at the Carnegie Institute of Technology, Pittsburgh, Pa., on Tuesday morning, September 5, 1922. Short addresses were given by J. O. Handy, chairman of the Pittsburgh Section, John G. Bowman, chancellor of the University of Pittsburgh, and Thomas S. Baker, acting president of the Carnegie Institute of Technology. Dr. Edgar F. Smith responded on behalf of the society. The address of Edward E. Slosson on "The constructive chemist" was the feature of the morning and was heartily enjoyed by all those who had the privilege of hearing it. No business was transacted at the general meeting.

The following addresses were given at the afternoon session in the Carnegie Music Hall: "The chemical control of gaseous detonation with particular reference to the internal combustion engine," by Thos. Midgley, Jr., and T. A. Boyd; "The journal literature of chemistry," by E. J. Crane; "Structural colors in feathers," by Wilder D. Bancroft; "How research made a potash industry," by John E. Teeple.

On Tuesday evening a complimentary smoker was given the members as guests of the Pittsburgh Section at the Syria Mosque. There were 1,325 people present. A very interesting program, with songs, local vaudeville entertainment, moving pictures, etc., was enjoyed by all. On Wednesday at 2 P.M. a conference on "World Metric Standardization," with Eugene C. Bingham, chairman, was held in the theater of the Fine Arts Building with the following delegates present:

American Chemical Society: Eugene C. Bingham.

National Academy of Sciences; T. C. Mendenhall.

American Society of Zoologists: Dr. H. H. Collins.

American Psychological Association: Professor W. V. Bingham.

American Institute of Electrical Engineers: N. W. Storer.

American Metric Association: W. W. Stevenson.

Optical Society of America: Harry S. Hower.

United States Bureau of Standards: F. S. Holbrook.

New York Mineralogical Club: Dr. George F. Kunz (Absent).

American Statistical Association: Professor Roswell H. Johnson.

Geological Society of America: Professor Roswell H. Johnson.

Association of Seed Analysts: Dr. E. M. Gress.

American Electrochemical Society: R. E. Zimmerman.

American Pharmaceutical Association: Dean J. A. Koch.

National Society for the Study of Education: J. Freeman Guy (Absent).

American Astronomical Society: Professor Herman S. Davis.

Maryland Academy of Science: Dr. Claude H. Hall.

American Association of University Professors: Professor Alexander Silverman.

Ecological Society of America: A. E. Ortman (Absent).

American Institute of Architects: T. E. Billquist.

American Society of Biological Chemists: Howard B. Lewis (Absent).

American Society of Civil Engineers: R. A. Cummings.

American Mathematical Society: Professor F. L. Bishop.

American Medical Association: Dr. Paul N. Leech.

American Physiological Association: Dr. C. C. Guthrie.

American Public Health Association: Dr. Wadsworth.

Illuminating Engineering Society: E. J. Edwards.

Mathematical Association of America: Professor F. L. Bishop.

Sullivant Moss Society: Dr. O. E. Jennings.

The same evening a reception was held and President Edgar F. Smith gave the annual presidential address under the title "Our Science." On Thursday evening a garden party, followed by supper and an out-of-door dramatic entertainment, "The Wonder Hat," was the chief entertainment of the meeting. The party was held at "Oak Manor," which is the University of Pittsburgh faculty and Mellon Institute club house. The weather was ideal. Some 1,500 persons were present and a thoroughly delightful social evening, including

also music and dancing, was enjoyed by all. On Friday, excursions were made to the Carnegie Steel Company's Clairton by-product coke plant, the steel works and to the American Window Glass Company's plant at Monongahela City. The ladies were entertained throughout the week with receptions, dinners and excursions. Further details will be found in the October issue of the *Journal of Industrial and Engineering Chemistry*.

The following divisions and sections met: Divisions of Agricultural and Food Chemistry, Biological Chemistry, Dye Chemistry, Fertilizer Chemistry, Industrial and Engineering Chemistry, Leather Chemistry, Chemistry of Medicinal Products, Organic Chemistry, Physical and Inorganic Chemistry, Rubber Chemistry, Sugar Chemistry, Water, Sewage and Sanitation Chemistry, and Sections of Cellulose Chemistry, Chemical Education, Gas and Fuel, History of Chemistry and Petroleum Chemistry. Full details of their meetings will be found in the October issue of the *Journal of Industrial and Engineering Chemistry*.

The divisions elected officers as follows:

Division of Agricultural and Food Chemistry: *Chairman*, H. A. Noyes; *vice-chairman*, R. H. Carr; *Secretary*, C. S. Brinton; *executive committee*, T. J. Bryan, Harper F. Zoller.

Division of Biological Chemistry: *Chairman*, J. S. Hughes; *secretary*, W. V. Bovie; *executive committee*, H. B. Lewis, *chairman*, A. W. Dox. D. B. Jones, A. R. Lamb, J. F. Lyman.

Division of Cellulose Chemistry: *Chairman*, G. J. Esselen, Jr.; *vice-chairman*, Louis E. Wise; *secretary-treasurer*, L. F. Hawley; *executive committee*, Harold Hibbert, J. F. Waite.

Division of Dye Chemistry: *Chairman*, W. J. Hale; *vice-chairman*, R. E. Rose; *secretary*, R. Norris Shreve; *executive committee*, L. A. Olney, L. F. Johnson.

Division of Fertilizer Chemistry: *Chairman*, F. B. Carpenter; *vice-chairman*, R. N. Brackett; *secretary*, H. C. Moore; *executive committee*, H. J. Wheeler, C. H. Jones, E. W. Magruder, A. J. Patten.

Division of Industrial and Engineering Chemistry: *Chairman*, D. R. Sperry; *vice-chairman*, W. A. Peters; *secretary*, E. M. Billings; *executive committee*, W. F. Hillebrand, Edward Mallinckrodt, Jr., F. M. DeBeers, A. Silverman, H. C. Moody, C. E. Coates.

Division of Leather Chemistry: *Chairman*, J. Arthur Wilson; *vice-chairman*, Charles S. Hollander; *secretary*, Arthur W. Thomas; *executive committee*, F. P. Veitch, C. R. McKee.

Division of Chemistry of Medicinal Products: *Chairman*, Edgar B. Carter; *secretary*, E. H. Volwiler; *executive committee*, Charles Caspari, Oliver Kamm.

Division of Organic Chemistry: *Chairman*, Frank C. Whitmore; *vice-chairman and secretary*, R. R. Renshaw.

Division of Petroleum Chemistry: *Chairman*, C. E. Delbridge; *vice-chairman*, R. R. Matthews; *secretary*, W. A. Gruse; *executive committee*, E. W. Dean, W. F. Faragher.

Division of Physical and Inorganic Chemistry: *Chairman*, Robert E. Wilson; *secretary*, Graham Edgar; *executive committee*, Farrington Daniels, J. H. Ellis, James Kendall, E. B. Millard, R. G. Van Name.

Division of Rubber Chemistry: *Chairman*, W. B. Wiegand; *vice-chairman*, E. B. Spear; *secretary*, Arnold H. Smith; *executive committee*, C. W. Bedford, D. F. Cranor, G. S. Whitby, H. L. Fisher, N. A. Shepard.

Division of Sugar Chemistry: *Chairman*, W. D. Horne; *vice-chairman*, F. W. Zerban; *secretary*, Frederick J. Bates; *executive committee*, W. B. Newkirk, C. E. Coates, C. A Browne, S. J. Osborn, H. S. Paine, H. E. Zitkowski.

Division of Water, Sewage and Sanitation Chemistry: *Chairman*, A. M. Buswell; *vice-chairman*, F. R. Georgia; *secretary*, W. W. Skinner; *executive committee*, W. R. Copeland, W. D. Collins.

DIVISION OF BIOLOGICAL CHEMISTRY

Howard B. Lewis, *chairman*

J. S. Hughes, *secretary*

The action of sodium soaps on trypsin. J. B. BROWN. The sodium soaps of the higher fatty acids have been found to destroy trypsin very rapidly. The amount of destruction of enzyme depends on the concentration of the soap and the time of exposure of enzyme to soap. The presence of protein substrate protects the enzyme and lessens the destruction. The satured and unsatured soaps are about equally destructive. Sodium soaps destroy the autolytic enzymes of dog liver and the ptyalin of human saliva. The action of soaps on these enzymes is much greater than can be accounted for as a p_H effect.

Metabolic disturbances in cats on a milk diet. GEORGE W. PUCHER and KARL F. CORI. A very interesting influence of milk on the alkalimetabolism of cats has been observed and studied

quantitatively. The striking features are summarized as follows: (1) Cats fed on meat and water excrete a urine normal for carnivorous animals. The total carbon dioxide content of the urine is very small and constant in value. (2) Cats when fed on milk excrete within 24-48 hours a urine which shows the following qualities: (*a*) Alkaline to brilliant yellow and even to phenolphthalein. (*b*) Substances which easily reduce Benedict's solution (5 minutes). (*c*) Huge amounts of bicarbonates (calculated from total CO_2 evolved). (*d*) Increase of the ammonia and the ammonia total nitrogen ratio. (3) Within 48 hours after the withdrawal of the milk the animals returned to normal. (4) Milk sugar is not responsible for these changes.

The effect of various methods of pasteurization on the vitamin C content of milk. J. S. HUGHES, N. E. OLSON and J. C. JENKINS.

The relationship between the inhibition point of fungicides and their concentration and their molecular weight. ERNEST BATEMAN. There is a definite relationship between the concentration of fungicides and the relative retardation in the growth of the fungus. This relationship can be expressed mathematically by the equation $\frac{R}{Cm^b} = K$ where *Cm* is the concentration in mols, *b* an exponent depending upon the structure of the compound, *R* the percentage retardation and *K* a constant. There is a definite relationship between the molecular weight of poisons in homologous series and their inhibition point. This relationship can be expressed by the equation $CM^d = K$ where *C* is the concentration at the killing point, *M* the molecular weight of the compound, *d* an exponent which is possibly governed by the organism and *K* a constant.

The proteins of wheat bran. D. BREESE JONES and C. E. F. GERSDORFF.

The nutritive value of the proteins of the palm kernel. A. J. FINKS and D. BREESE JONES.

Proteins from the cantaloupe seed (Cucumis melo); isolation of a crystalline globulin. D. BREESE JONES and C. E. F. GERSDORFF.

The physico-chemical properties of strong and weak flours. IV. The influence of the ash of flours upon the viscosity of flour-water suspensions. ROSE AIKEN GORTNER and PAUL F. SHARP. The viscosity of acidified flour-water suspensions is markedly influenced by the ash contained in the flour. The greater part of such ash may be removed by lixiviating the flour with water and using the leached residue for viscosity determinations. Such studies have led to the formula:

$$\text{Log viscosity} = a + b \text{ (log concentration)}$$

where *a* and *b* are constants, and the viscosity is the maximum viscosity obtainable with lactic acid. The numerical value of *b* is a measure of the colloidal properties of the gluten as influencing flour strength.

The physico-chemical properties of strong and weak flours. V. The identity of the gluten protein responsible for changes in hydration capacity as measured by viscosity. PAUL F. SHARP with ROSS A. GORTNER. The maximum viscosity of acidulated (lactic acid) flour-water suspensions from which the ash has been leached is but little altered by repeated lixivation continued until all, or practically all, of the gliadin has been removed. Glutenin is the only protein present in such a preparation in any considerable quantity, and it is the physical state of the glutenin which is responsible for changes in hydration capacity of wheat flour gluten.

The physico-chemical properties of strong and weak flours. VI. The physical state of the gluten as affecting loaf volume. PAUL F. SHARP with ROSS AIKEN GORTNER. Experiments by other workers have shown that an inferior loaf results when gliadin is removed from a flour by extraction with alcohol and the gliadin-free flour is dried, remilled and baked. This has been interpreted as indicating that the absence of gliadin is the determining factor of the poor baking results. We have found that essentially the same results may be obtained when flour is doughed up with 85 per cent. alcohol and the whole mass dried, remilled and baked. Here nothing was added to or taken from the flour. Nevertheless the flour "strength" is destroyed. The alcohol treatment has destroyed the colloidal properties of the glutenin and any agent which influences the colloidal properties of the glutenin will affect loaf volume.

The quantitative production of furfural from pentose material. N. C. PERVIER with ROSS AIKEN GORTNER. Furfural in theoretical yield may be distilled from pentose material by boiling with 12 per cent. HCl and at the same time passing a rapid current of steam through the solution.

The quantitative estimation of furfural by electrometric titration. N. C. PERVIER with ROSS AIKEN GORTNER. Furfural can be quantitatively titrated with bromine. We have employed a standard solution of potassium bromate, titrating in the presence of KI and 5 per cent. HCl, using

a galvanometer as an indicator. Two atoms of bromine are required for each molecule of furfural. Laevulnic acid and hexoses do not interfere in the estimation of pentose material by its conversion first into furfural and the subsequent titration.

Methods for the estimation of total solids and hydrophilic colloid content of expressed plant tissue fluids with certain phytochemical applications. ROSS AIKEN GORTNER, ROBERT NEWTON and WALTER F. HOFFMAN. The refractive index of a plant sap as measured by an Abbe refractometer may be used to measure quantitatively the total solids present in the sap. A measurement of "bound water" is used to estimate the hydrophilic colloid content. The depression of the freezing point of the original sap is obtained. Then a quantity of sucrose just sufficient to make a molar solution in the total water present is added and the depression of the freezing point is again obtained. The excess depression (over the theoretical 2,085 due to molar sucrose) is due to a part of the water being held by the hydrophilic colloids in such a manner as to be unavailable for the solution of sucrose.

The origin of the humin formed by the acid hydrolysis of proteins. VII. Hydrolysis in the presence of ketones. ROSS AIKEN GORTNER and EARL R. NORRIS. Ketones do not appreciably alter the nitrogen distribution of a protein as measured by Van Slyke's method. No evidence was obtained that ketones could be involved in humin formation. We believe, therefore, that humin formation is caused by the interaction of tryphophane and an aldehyde.

The tyrosine content of diaminized casein. H. B. LEWIS and RALPH C. CORLEY.

The influence of food on the excretion of endogenous uric acid in man. (By title.) H. B. LEWIS and RALPH C. CORLEY.

The synthesis and rate of elimination of hippuric acid in the organism of the rabbit. H. B. LEWIS and WENDELL H. GRIFFITH.

The analysis of the urine as a part of the physical examination of the college student. G. O. HIGLEY. This work was begun in 1915 because of the death of a college student from diabetes. Tests are made for sugar and for albumin, and in special cases for other pathological substances. Each year a considerable number of cases of nephritis are discovered, of which about two thirds show a previous history of an acute attack of that disease. When any pathological substance is detected a second and often a third sample of urine is tested, and the student is advised to consult a competent physician and to report his findings to the college physical examiner.

Further observations on the influence of vitamin B on the development of organs in Single Comb White Leghorn cockerels. ARTHUR J. SOUBA and R. ADAMS DUTCHER. Six hundred and nine chicks were hatched from eggs of pure line stock and placed on a normal chick ration. At the age of 76 days 150 normal cockerels were selected and divided in three groups, designated A, B and C. Group A received a normal ration with greens, Group B received an adequate synthetic diet and Group C received a synthetic diet, adequate in all particulars except vitamin B. After four weeks 25 birds in each group were killed and weights and measurements recorded on testes, heart, kidneys, spleen, pancreas, liver, thyroid and suprarenals. The remaining birds were allowed to continue until polyneuritis developed in Group C, at which time one bird from Groups A and B, including the polyneuritic bird, were killed. All data were treated biometrically. The absence of vitamin B produced significant losses in the weight of testes, heart, liver and kidneys. Differences in length of heart and spleen were also apparent.

Is nitrogen in gaseous form lost from germinating seed and young seedlings as an inherent function of their metabolic processes? JEHIEL DAVIDSON.

Influence of lysine upon the hydrolysis of starch by purified pancreatic amylase. H. C. SHERMAN and MARY L. CALDWELL. This is an extension of the work with arginine, histidine and tryptophane which was reported by the same authors last year. Lysine resembles histidine and tryptophane in not increasing the amyloclastic activity of pancreatic amylase while both lysine and tryptophane do increase its saccharogenic activity. These results are best interpreted in terms of the theory that the favorable influence of amino acids is attributable to their effect in checking the hydrolytic destruction of the enzyme in the aqueous dispersions in which it acts. The theoretical part of the paper does not lend itself to further condensation.

Influence of some organic compounds upon the hydrolysis of starch by salivary and pancreatic amylases. H. C. SHERMAN and NELLIE M. NAYLOR. In order to test the question whether the organic substances, which have been reported as favoring the activity of amylases, have a directly activating effect upon the enzyme by reason of their organic groupings, experiments

have been made with aniline, methyl and ethyl amines, benzoic benzamide, anthranilic acid and hippuric acid. These substances collectively contain the amino and carboxyl groups both singly and in different combinations but none of them showed any favorable influence upon the activity of salivary or pancreatic amylase when tested under what are now regarded as standard conditions for the activity of these enzymes. The results fail to furnish any support for the view that certain organic groupings as such activate amylolytic action. They make it much more probable that the favorable influence of α-amino acids upon amylases is to be attributed primarily if not entirely to their effect in preserving the enzyme from hydrolytic destruction.

Effect of amino acids in retarding the hydrolytic decomposition of an enzyme (pancreatic amylase). H. C. SHERMAN and FLORENCE WALKER. The extent of the deterioration of this enzyme when allowed to stand in solution for different lengths of time and at different temperatures with and without the addition of amino acid has been determined. The higher the temperature, up to the point at which coagulation begins, or the longer the time of heating, the more marked was the favorable effect of the added amino acid, thus confirming the view that the enzyme in its chemical composition either is a protein or contains protein as an essential constituent, and that the added amino acid exerts its favorable influence by checking the hydrolytic destruction of the enzyme.

Catalytic action of phosphates on the separate and simultaneous oxidation of glucose and butyric acid with peroxide. EDGAR J. WITZEMANN.

Energy expenditures by women during horizontal walking at different speeds. H. MONMOUTH SMITH and DORTHA B. BAILEY. Using the Douglas-Haldane method of measuring the gaseous exchange the energy expenditure of nine women was determined when standing and walking at speeds of 30, 60 and 90 meters a minute. The average standing expenditure was 0.606 calorie per minute per square meter of body surface computed by Du Bois height-weight chart. The total increase for the walking over the standing values showed an average expenditure for the nine subjects of 0.527, 0.489 and 0.552 gram-calorie per horizontal kilogrammeter for the speeds of 30, 60 and 90 meters per minute respectively. Seven out of the nine subjects showed a greater energy expenditure per horizontal kilogrammeter at 30 meters per minute than at 60. The menstrual period was apparently without effect on either the standing or walking metabolism.

The substitutions of glass electrodes for the hydrogen electrodes in electrometric titration. WALTER S. HUGHES.

Oxidation-reduction potentials and the stability of vitamin C. VICTOR K. LAMER. The difference in acidity is insufficient to account alone for the much greater stability of vitamin C to heat in the case of tomato and citrus fruit juices compared to that of cabbage juice where almost complete destruction occurs on boiling for one hour in the absence of air. The oxidation-reduction potentials of these juices, freshly expressed, were determined electrometrically in the absence of atmospheric oxygen. The potentials, when corrected for p_H, indicate that the stability of the vitamin depends upon the natural oxidizing or reducing condition of the juice as well as upon the opportunities that are afforded for atmospheric oxidation.

Flour strength as influenced by the addition of diastatic ferments. F. A. COLLATZ. The optimum activity for the diastase in malt flour with raw wheat starch as a substrate was found at p_H 4.26 and at a temperature of 65 degrees C. This activity was apparently constant over the period of digestion. The reducing sugars increased proportionately to the amount of diastase added. The viscosity of the digestion mixture (plus lactic acid) decreased with increasing amounts of added diastase and also with the time of digestion. This decrease is apparently not due to the salt effect. The gas producing capacity of strong flours is not increased by diastase, but with weak flours the reverse is the case.

Changes in hydrogen-ion concentration of fermenting dough. (By title). F. A. COLLATZ.

The synthesis of vitamins by molds. V. E. NELSON, ELLIS I. FULMER, V. G. HELLER and W. W. DUECKER. Yeast grown on medium F is about 60 per cent. as potent in vitamin B as Fleischmann's yeast; the above synthetic yeast will cure polyneuritis in pigeons. Air drying destroys about 30 per cent. of the vitamin B potency of yeast. *Aspergillus niger* and *Penicillium expansum* synthesize vitamin B when grown on Raulin's medium but do not synthesize vitamin A. The potency in vitamin B is about the same as that of our synthetic yeast. *Sclerotinea cinerea* shows vegetative growth on medium F but does not sporulate. The mycelia, according to incomplete data, shows no vitamin B. The work is being continued.

The use of kelp in the preparation of a diet

amendment for use in the treatment and prevention of deficiency diseases, particularly goiter. (By title). J. W. TURRENTINE.

SECTION OF CHEMICAL EDUCATION

Edgar F. Smith, *chairman*

Neil E. Gordon, *secretary*

Pandemic chemistry. WILDER D. BANCROFT. There is a great need for a course in chemistry which shall be intended for the man who wishes to learn something about the subject as a part of a general education; but who has no intention of going on with the subject. Such a course should cover the whole field of chemistry in an interesting way without wasting time on technical details. Cornell University is considering seriously starting such a course when the new chemical laboratory is finished. A general outline of the proposed course is given.

What chemistry shall be taught in high school and how shall it be correlated with college chemistry? LOUIS W. MATTERN. Stress is placed on the adaptability of chemistry in high schools to the development of certain habits and mental traits not only essential to the successful study of chemistry and other scientific subjects in colleges, but, as well, to the average citizen, at a time when such habits and mental traits are better obtained than in college. A discussion is made of the problems in the articulation between high school chemistry and college chemistry. A brief statement of content to cover less ground and to emphasize unity in high school chemistry is made with a view of the high school taking to college a greater thoroughness in fundamental principles, their relationships and the ability to apply them.

What chemistry shall be taught in the first year of college and how shall this be correlated with high school chemistry. HARRY N. HOLMES. High school chemistry is valuable as a training in scientific thinking but it should not be forced to prepare the student for second year college chemistry. First year college chemistry must consolidate what was learned before in an interpretive spirit and must introduce much new material. It should give much more attention to physical chemistry, organic chemistry, qualitative analysis —and be more quantitative in general. The research attitude of mind may be stimulated even in the first year. In dividing a large class into groups—the more elementary and the more advanced—the judgment of the teacher should be influenced by the records of the high schools from which students came and by a more or less formal quiz on high school chemistry.

What chemistry shall be taught in our professional schools? L. B. BROUGHTON. The chemical requirements for pre-medical students are cited as specified by the American Medical Association. The question is raised as to how the colleges of liberal arts and science should deal with this type of chemical training, with suggestions that some adaptations could be made.

Chemical education in dental schools. WORTLEY F. RUDD. The following points were covered in this paper: (1) Needs of freshmen students in chemistry in those dental schools requiring only high school graduation for matriculation. (2) Needs in those schools requiring one year of college work for matriculation. (3) The proper correlation of dental metallurgy and dental chemistry.

Chemical education in pharmacy schools. JOHN C. KRANTZ, JR. The purpose of the paper was to point out the objections to the teaching of strictly applied pharmaceutical chemistry in pharmacy schools, and also to show that the substitution of general college chemistry does not supply the needs of pharmacy students. The paper also describes an efficient and comprehensive method of correlating general and pharmaceutical chemistry in order to meet the demands of the pharmacy student.

What chemistry should be taught an agricultural student. C. W. STODDART. General inorganic and agricultural chemistry should be given to all agricultural students. Qualitative analysis should be a part of general chemistry. Organic chemistry and possibly quantitative analysis should be a part of agricultural chemistry, although the latter is not necessarily a part of the laboratory work of agricultural chemistry. For specialists in agricultural chemistry a separate course in organic chemistry is essential, and it ought to be "well rubbed in." They need also a course in quantitative analysis but combining theory with agricultural practice, not too distinct courses. Agricultural chemists must be well grounded in chemistry. But after all the teacher is the principal item in what chemistry should be taught to an agricultural student.

Qualitative analysis for engineering students. CHARLES W. CUNO. A short synopsis of the paper follows: (1) A discussion of the present methods of teaching qualitative analysis as a preliminary to other courses in chemistry. (2) A questioning of the wisdom of such a course for civil, mechanical and electrical engineers. (3) Suggestions: (*a*) For the modification of the course. (*b*) For a new course.

An experience with the general intelligence test in teaching freshmen chemistry. EDWARD BARTOW and JACOB CORNOG. A comparison of intelligence ratings as determined by a general intelligence test given at the beginning of the year with the final grades received by 948 students in freshmen chemistry gives a coefficient of correlation of .44 where complete causation would be represented by unity and no causation by zero. This indicates that intelligence as determined by this test is a partial but not predominant factor in determining final grades. The general intelligence test may be used in evaluating teaching performance of large numbers of teachers giving instruction in the same subject; for effecting economy in administration by early elimination of students of hopelessly low capacity; and for comparison of the mental potentialities of different groups of students. The general intelligence test does not afford a dependable basis for accurately forecasting a student's final grade in individual cases, except for students of extremely low intelligence.

The teaching of chemistry in negro private schools. B. T. HARVEY, JR. This paper presented some facts and conclusions derived from an investigation of the teaching of chemistry in negro private schools by means of personal observation, answers to a questionnaire and study of the catalogs of these institutions. After a preliminary survey of the scope of negro education and its effects, a statement of the aims of the courses in chemistry was made. Practice and results in these schools were checked by aims, finally suggestions were made for help in meeting difficulties involved in the teaching of chemistry in negro private schools.

Quantitative experiments in general chemistry. H. W. MOSELEY. In this paper the question was raised as to whether quantitative experiments usually assigned to students in general chemistry laboratory served their purpose; and as a result of this study a plan was suggested for the assignment of quantitative work to such students in a way to get results. Data were included.

The student's laboratory bench and his supplies. W. L. ESTABROOKE. The purpose of this paper was to trace the development of the student's laboratory bench during the past twenty-five years and the corresponding improvement in the method of handling his supplies. Two new student's desks were shown, one of which was a radical departure from that usually seen in chemical laboratories. The handling of student's chemicals was described by the writer in SCIENCE of May 30, 1919, under the heading "The Freas System" in honor of Thomas B. Freas of Columbia University, who has done more than most men in America to meet this problem. The exhibit consists of: (1) The chemicals used in one year of inorganic chemistry at the College of the City of New York. (2) The chemicals used in one year of qualitative analysis at the College of the City of New York. (3) The Fales' student's bench in inorganic chemistry, borrowed from Professors Freas and Fales of Columbia University, with a full equipment of apparatus and chemicals.

A system of individual reagents for courses in qualitative analysis. LOUIS J. CURTMAN. The author has designed two small wooden kits provided with shelves and capable of holding all the reagents, solids and solutions needed in qualitative analysis. These kits are of such dimensions that they can easily be locked up in the student's locker or cupboard. The shelves are specially constructed to permit the labels on the bottles to be plainly seen and to allow the bottles to be easily removed and replaced. Bottles of six different sizes are used depending upon the quantity of material needed. A set of solid salts and compounds, contained in a pasteboard box, is also provided. From this small supply of chemicals the student weighs out the quantities needed for making his solutions. In the Freas system, which is in use at Columbia University, the student is provided with all the solutions he needs. In the author's method, the student is required to prepare all his solutions. The advantages of this system are: (1) The student becomes acquainted with the physical properties of the solid substances he used. (2) He is required to calculate, in each case, the quantity of salt needed to prepare a specified volume of a solution of definite normality. (3) By actually making up the solutions, he becomes familiar with the characteristic properties of such substances which require special treatment. This information he can obtain by no other method. The system outlined above has been successfully used at the College of the City of New York for the past five years. A paper describing this system in detail will shortly be published.

The teaching value of the electrochemical series of metals. R. A. BAKER. It is recommended that at the beginning of the course in general chemistry, each student be required to learn the names and symbols of the common metals, arranged in the order of the electrochemical series, together with the physical properties of the

metals as a group. For the remainder of the course the conventional order is preserved. As each non-metal is studied, its chemistry is projected on to this series of metals, with the result that no special consideration of the metals is required at the close. This arrangement causes any student who had studied chemistry before to adopt such a different point of view that he is fully occupied in applying the knowledge he already possesses. The exact order of the electrochemical series is an aid to the student in interpreting, correlating and directing his own experimentation. Use may be made of it in connection with the heats of formation of the metal oxides, hydroxides, nitrates, etc.; the replacements of metals by each other; the strength of bases, etc.

The schoolmaster and the teacher. E. G. MAHIN. The problems of the teacher of chemistry are briefly discussed and stress is laid upon correct personality of the teacher as an absolute prerequisite to successful teaching of science. Lack of interest on the part of the student frequently springs from lack of respect for the sincerity of the teacher. Science is the truth of nature and as such it must be respected. Before it sham and imposture must eventually give way. This conviction must be made a part of the student's training or he will never possess correct ideals of his life work.

The possibility of improvement in the contributions colleges make to industries. EDWARD ELLERY.

Proper methods of conducting undergraduate research. WILLIAM A. NOYES. Two purposes should be constantly in the mind of the teacher who directs research work of undergraduates. First, the student should be trained in the use of chemical literature. He should learn how to find for himself the results of previous work on the problem he is studying. Second, he should be taught to develop personal initiative in attacking a problem. He should never be considered merely an agent to carry out an experiment which the teacher wishes to be performed.

The best college course for the chemist. ROBERT E. ROSE. What the industries most desire is a well balanced education in those who enter their research laboratories. Chemistry, as it is taught at present, is sub-divided much too rigidly, and the several parts are not treated in the proper perspective. A course is outlined which would give a general survey of the whole field of chemistry during the first year. This would be valuable to those specializing in chemistry as well as to students desiring the course for its cultural value. The essentials in science and in the correlated subjects for the four year course are discussed, and the content of the courses outlined. The suggestions call for a totally different treatment of all our science classes.

The education of the chemist. J. B. GARNER. The subject is one regarding which there is a diversity of opinion varying from that of the dreamy academician to that of the true practicalist. Both the unreasonable expectation of the classical pedant to justify his idea of culture and the behest of the industrialist to meet immediate technical demands sacrifice the ultimate welfare of the chemist in training. Experience has shown that personality, mentality and professional training are the essential elements in the make-up of a chemist. Personality is one of the most valuable assets of the chemist. Personal qualities protrude more in concerted research than in any other human endeavor. Personality is made up of the qualities of resourcefulness, creativeness, initiative, pertinacity, cheerfulness, loyalty, honesty and courtesy. Mentality is the mental power, or the right kind of brains for successful issue in matters chemical. Mentality comprehends consciousness, thought, opinion, memory, reason, decision, purpose, common sense and tact. The real character of the chemist is in his purpose and the strength of his character is in the decision and firmness of this purpose. Personality and mentality energize and give direction to professional training. The test of the adequacy of professional training is the use of this training. It must be sufficient when combined with personality and mentality to supply that which is needed as one's life program. Men must be trained by colleges, technical schools and universities to adapt themselves with certainty to the new economic conditions. Therefore, courses of study must be rearranged as to their content, and curricula must be formulated. The subject matter of all courses must be such that contact with real life, actual conditions, and needs, is made. Education is for life and for service. The general scope of training must be as extensive, and the time required for its completion as great, as that for the profession of medicine. Chemists must be industry builders and developers of national natural resources. A proposed outline of courses for the professional training of the chemist will be offered. As far as professional training is concerned, the shortcomings of the chemist are largely English, chemical literature, German, French, quantitative analyses and general engineering.

CHARLES L. PARSONS,
Secretary